CLAIMS

S06 D1

1. An image compression and expansion apparatus comprising:

a reduced image generating processor that generates, based on original image data arranged in a first matrix comprised of a plurality of pixels, reduced image data arranged in a second matrix comprised of a smaller number of pixels than said first matrix;

a reduced image recording processor that records said reduced image data in a recording medium;

an orthogonal transforming processor that reads said reduced image data from said recording medium and applies orthogonal transformation to obtain orthogonal transformation coefficients arranged in said second matrix; and

an expanded image generating processor that applies inverse orthogonal transformation to said orthogonal transformation coefficients to obtain expanded image data arranged in a third matrix comprised of a greater number of pixels than said second matrix.

2. An image compression and expansion apparatus comprising:

a reduced image generating processor that generates, based on original image data arranged in a first matrix comprised of a plurality of pixels, reduced image data arranged in a second matrix comprised of a smaller number of

pixels than said first matrix;

a reduced orthogonal transformation coefficient data recording processor that records reduced orthogonal transformation coefficient data, obtained by orthogonal transformation of said reduced image data, in a recording medium; and

an expanded image generating processor that reads said reduced orthogonal transformation coefficient data from said recording medium and applies inverse orthogonal transformation to obtain expanded image data arranged in a third matrix comprised of a greater number of pixels than said second matrix.

3. The image compression and expansion apparatus according to ~~one of claims 1 and 2,~~ claim 1 wherein said reduced image generating processor obtains an average value of a predetermined number of pixel values included in said first matrix, and sets said average value as one pixel value corresponding to a predetermined number of pixels included in said second matrix.

4. The image compression and expansion apparatus according to claim 3, wherein said average value is obtained from 8 x 8 pixel values included in said first matrix.

5. The image compression and expansion apparatus according to ~~one of claims 1 and 2,~~ claim 1 wherein said second and third matrixes are comprised of n1 x m1 and n2 x m2 pixels,

respectively, and n2 and m2 are $2^N$ times n1 and $2^M$ times m1, respectively (where n1, m1, n2, m2, N and M are positive integers).

6. The image compression and expansion apparatus according to ~~one of claims 1 and 2,~~ claim 1 wherein said first matrix is comprised of 64 x 64 pixels and said second matrix is comprised of 8 x 8 pixels.

7. The image compression and expansion apparatus according to ~~one of claims 1 and 2,~~ claim 1 wherein the numbers of pixels contained in said first and third matrixes are the same.

8. The image compression and expansion apparatus according to ~~one of claims 1 and 2,~~ claim 1 wherein said first and third matrixes are each comprised of 64 x 64 pixels.

9. The image compression and expansion apparatus according to ~~one of claims 1 and 2,~~ claim 1 wherein said orthogonal transformation is a two dimensional discrete cosine transformation and said inverse orthogonal transformation is a two dimensional inverse discrete cosine transformation.

10. The image compression and expansion apparatus according to claim 9, wherein said first, second, and third matrixes are comprised of 64 x 64, 8 x 8, and 64 x 64 pixels, respectively, and said expanded image generating processor obtains expanded image data by a two dimensional inverse discrete cosine transformation expressed by the following formula:

Am $B_2$

$$\cancel{I'^{(s,t)}_{yx} = \frac{1}{4}\sum_{u=0}^{7}\sum_{u=0}^{7} CuCvD^{(s,t)}_{vu} \cdot \cos\frac{(2x+1)u\pi}{128}\cos\frac{(2y+1)v\pi}{128}}$$

$B_2$

wherein, 0≤x≤63, 0≤y≤63, $I'_{yx}$ is the pixel value of expanded image data, Cu, Cv=$1/2^{1/2}$ when u, v=0, Cu, Cv=1 when u, v≠0, and $D_{vu}$ is a DCT coefficient obtained by said two dimensional discrete cosine transformation.

Sub C1

11. A pixel number increasing apparatus comprising:

an orthogonal transforming processor that applies orthogonal transformation to image data arranged in a fourth matrix comprised of a plurality of pixels to obtain orthogonal transformation coefficients of image data arranged in said fourth matrix; and

an expanded image generating processor that applies inverse orthogonal transformation to said orthogonal transformation coefficients to obtain expanded image data arranged in a fifth matrix comprised of a greater number of pixels than said fourth matrix.

Sub B1

12. The pixel number increasing apparatus according to claim 11, wherein said orthogonal transformation is a two dimensional discrete cosine transformation and said inverse orthogonal transformation is a two dimensional inverse discrete cosine transformation.

Sub C2

13. The pixel number increasing apparatus according to claim 12, wherein said fourth and fifth matrixes are comprised

of 8 x 8 and 64 x 64 pixels, respectively, and said expanded image generating processor obtains expanded image data by said two dimensional inverse discrete cosine transformation expressed by the following formula:

$$I'^{(s,t)}_{yx} = \frac{1}{4}\sum_{u=0}^{7}\sum_{u=0}^{7} CuCvD^{(s,t)}_{vu}\cdot\cos\frac{(2x+1)u\pi}{128}\cos\frac{(2y+1)v\pi}{128}$$

$B_3$

wherein, $0 \le x \le 63$, $0 \le y \le 63$, $I'_{yx}$ is the pixel value of expanded image data, Cu, $Cv=1/2^{1/2}$ when u, v=0, Cu, Cv=1 when u, $v \ne 0$, and $D_{vu}$ is a DCT coefficient obtained by said two dimensional discrete cosine transformation.

14. A pixel number increasing apparatus comprising an expanded image generating processor that applies inverse orthogonal transformation to image data arranged in a sixth matrix comprised of a plurality of orthogonal transformation coefficients to obtain expanded image data arranged in a seventh matrix comprised of a greater number of pixels than said sixth matrix.

15. The pixel number increasing apparatus according to claim 14, wherein said orthogonal transformation is a two dimensional discrete cosine transformation and said inverse orthogonal transformation is a two dimensional inverse discrete cosine transformation.

16. The pixel number increasing apparatus according to claim 15, wherein said sixth and seventh matrixes are

comprised of 8 x 8 and 64 x 64 pixels, respectively, and said expanded image generating processor obtains expanded image data by said two dimensional inverse discrete cosine transformation expressed by the following formula:

$$\cancel{I'^{(s,t)}_{yx} = \frac{1}{4}\sum_{u=0}^{7}\sum_{u=0}^{7} CuCvD^{(s,t)}_{vu}\cdot\cos\frac{(2x+1)u\pi}{128}\cos\frac{(2y+1)v\pi}{128}}$$

B1

wherein, $0 \le x \le 63$, $0 \le y \le 63$, $I'_{yx}$ is the pixel value of expanded image data, Cu, $Cv=1/2^{1/2}$ when u, v=0, Cu, Cv=1 when u, v≠0, and $D_{vu}$ is a DCT coefficient obtained by said two dimensional discrete cosine transformation.